NASA SCIENCE MISSION DIRECTORATE

Earth-Sun System Applied Sciences Program
Public Health Program Element
FY2006-2010 Plan

Version: FINAL DRAFT

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Expanding and accelerating the realization of economic and societal benefits from Earth-Sun System science, information, and technology

NASA Science Mission Directorate
Earth-Sun System Division
Applied Sciences Program

Applied Sciences for the Public Health Program Element:

This document contains the Public Health Program Element Plan for FY 2006-2010.
This plan derives from direction established in the NASA Strategic Plan, Earth Science Enterprise and Space Science Enterprise Strategies, Earth Science Applications Plan, and
OMB/OSTP guidance on research and development. The plan aligns with and serves the commitments established in the NASA Integrated Budget and Performance Document.

The Program Manager and the Applied Sciences Program Leadership have reviewed the plan and agree that the plan appropriately reflects the goals, objectives, and activities for the Program Element to serve the Applied Sciences Program, Earth-Sun System Division, NASA, the Administration, and Society.

(Signature on file) _____ _____
John Haynes Date
Program Manager, Public Health
Applied Sciences Program
NASA Earth-Sun System Division

(Signature on file) _____ _____
Lawrence Friedl Date
Lead, National Applications
Applied Sciences Program
NASA Earth-Sun System Division

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Ronald J. Birk Date
Director, Applied Sciences Program
NASA Earth-Sun System Division

NASA Earth-Sun System Division: Applied Sciences Program

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NASA Science Mission Directorate – Applied Sciences Program

Public Health Program Element Plan: FY 2006 - 2010

I. Purpose and Scope

This Applied Sciences National Applications Program Element Plan is applicable for Fiscal Years 2006 through 2010. The plan documents the purpose of the program and the implementation approach to meet the program objectives using the allocated resources. The plan describes the program element approach in extending NASA Earth-Sun system science research results to meet the decision support requirements of partner agencies and organizations. The Applied Sciences Program requires this plan to function as a program management tool, describing the program structure, functional mechanisms, performance measures, and general principles that will be followed in extending NASA research results for societal benefits.

Scope within NASA and Applied Sciences Program

Each National Applications Program Element is managed in accordance with, and is guided by, the NASA Strategic Plan and Earth Science Applications Plan. The program element benefits from NASA Earth-Sun system science research results and capabilities, including the fleet of NASA research satellites, the predictive capability of models in the Earth System Modeling Framework (ESMF), Project Columbia, the Joint Center for Satellite Data Assimilation (JCSDA), and the Earth-Sun System Gateway (ESG). The Applied Sciences Program seeks to develop with its partners scientifically credible integrated system solutions in which uncertainty characterization and risk mitigation has been performed using the capability of the national Earth-Sun laboratories and others in the community of practice.

The FY06 President's Budget for the NASA Applied Sciences Program specifies between $48 million and $55 million annually for FY06 – FY10. There are two elements to the Applied Sciences Program: National Applications and Crosscutting Solutions. Each National Applications Program Element benefits from the performance results of Crosscutting Solutions (see Crosscutting Solutions Program Element Plan). Each National Applications Program Element leverages and extends research results from the over $2 billion per year supporting Earth-Sun system science and development of innovative aerospace science and technology. Additional information about the NASA Applied Sciences Program can be found at http://science.hq.nasa.gov/earth-sun/applications.

NASA's Public Health Program Element extends products derived from science information, models, technology, and other capabilities into partners' decision support tools for public health, medical, and environmental health issues.1 The Public Health Program foci of partnerships with the public health practice community are their decision support systems known as Epidemiologic Surveillance Systems in the areas of:

- infectious disease
- environmental health

- bioterrorism

NASA collaborates with the professional public health community that is responsible for surveillance to understand and respond to factors in the environment that adversely impact the health of the American public. These factors include disease vectors, air and water contaminants, ambient temperature extremes, ultra-violet radiation and a myriad of other factors associated with public health problems. NASA's Public Health Program Element uses Earth observing instruments, advanced communication technology, high speed computing capabilities, data products, and predictive models of Earth-Sun System phenomena associated with the occurrence of disease to assist partners in enhancing their surveillance systems. International health is included in the scope of the Program as it represents a national health concern through its potential impact on American public health, economics, and national security. To this end, the program has strong connections with the Group on Earth Observations (GEO), the Interagency Working Group on Earth Observations (IWGEO), the World Health Organization (WHO), and The Observing-System Research and Predictability Experiment (THORPEX) program under the auspices of the World Meteorological Organization (WMO). The program also collaborates with the U.S. State Department.

The decision support structure of the public health community is based partially upon health information provided by epidemiologic surveillance. According to the Centers for Disease Control and Prevention (CDC), epidemiologic surveillance may be described as "the ongoing and systematic collection, analysis, and interpretation of health data in the process of describing and monitoring a health event." As outlined by CDC, the primary attributes of a surveillance system that combine to determine its usefulness for decision-makers include:

- simplicity: structure and ease of operation
- flexibility: adaptable to changing needs or operating conditions
- acceptability: willingness of individuals and organizations to participate
- sensitivity: proportion of disease detected, ability to detect epidemics
- predictive value positive: proportion of identified cases truly having the condition
- representativeness: accurately describes occurrence over time, distribution by place and person
- timeliness: speed or delay between steps in the system

A useful surveillance system enables the continual collection of data for monitoring disease trends and outbreaks for a public health response. While this data may be used for scientific investigations, research is not the primary purpose of a surveillance system. Surveillance systems are designed primarily to support decision makers.

In general, the incorporation of Earth-Sun science observations into measurement systems and models is intended to improve their accuracy with regard to spatial and temporal dimensions of the phenomena they represent. These improvements enhance the representative attribute of surveillance systems. The Public Health Program plans to enhance the ability of surveillance systems to assimilate observations and predictions of weather, climate and environmental risk factors to predict disease events. In surveillance terms, the goal for integrating Earth-Sun science and Public Health observations is to represent more accurately these environmental risk factors in terms of the populations potentially affected by them. The Public Health Program addresses four of the seven attributes of a reliable surveillance system: simplicity, flexibility, acceptability, and timeliness. These five attributes of partner surveillance systems will be enhanced by ensuring interoperability of Earth-Sun system science measurements with other important public health functions identified in the evaluation, verification, and validation stages of the collaboration.

NASA partners with federal agencies, and regional and national organizations that have public health responsibilities as well as mandates to support public health practitioners. Primary partners are the CDC, the National Institutes of Health (NIH), the U.S. Environmental Protection Agency (EPA), the Department of Health and Human Services (DHHS), the National Oceanic and Atmospheric Administration (NOAA), and the Department of Defense (DOD). The Program includes international organizations and activities with appropriate U.S. partners. The Public Health Program's activities relate to the Air Quality, Coastal Management, Ecological Forecasting, Homeland Security, and Water Management Program Elements. Through its activities, the Program provides results that support the White House National Science and Technology Council's (NSTC) Subcommittee on Environment and Health. The Subcommittee reports to three major NSTC committees, including the Committees on Science, Environment and Natural Resources, and Homeland Security. The Program strongly supports interagency programs on Climate Change Science and Technology (CCSP, CCTP). Priority Earth-Sun science measurements for the Public Health Program include those derived from sensors on: Aura, Terra, Aqua, EO-1, Landsat 7, TOMS-EP, SRTM, and SeaWiFS. NASA research has meaningful information on environmental factors associated with disease phenomena. The project plans associated with the Public Health Program identify specific sensors, measurements, and models, and state specific activities with the partners to extend Earth-Sun science results.

This plan covers projects, objectives, and activities for FY05-09. In FY05, the Public Health Program Element's activities continue to focus on evaluation, verification, and validation of environmental health, infectious disease, and bioterrorism-related decision support tool requirements. The Program engages in the capacity for NASA observations and predictions to be extended to serve risk management and network development activities such as studying safeguards for confidentiality of personal medical information when integrated with Earth-Sun science observations. In FY06-09, the Program's priorities focus on: evolving observation and prediction products for an identified suite of decision support tools, identifying and evaluating new Public Health decision support tools, and implementing risk management and network development plans.

II. Goals and Objectives

Goals

The goal of the Public Health Program Element is to:

- Enable partners' beneficial use of NASA Earth-Sun science observations, models, and technologies to enhance decision support capabilities that serve the core functions of public health practice - assessment, policy development, and assurance.

Objectives

All National Applications Program Elements are aligned to the NASA Strategic Plan and the agency's objectives as expressed in the NASA Integrated Budget and Performance Document (IBPD) and the Performance Assessment Rating Tool (PART).

Specifically, the NASA Public Health Program Element pursues the following short and near term objectives (see Section IV for other details):

Short-Term Objectives (FY06)

Date: September 2006
Objective: Establish formal collaborative agreements with at least one federal Public Health partners.
Planned Agreements: DHHS/SCC

Date: September 2006
Objective: Publish evaluation/demonstration reports on projects chosen in the 2005 Decision solicitation

Date: September 2006
Objective: Submit and publish at least one article on public health application results of Earth-Sun science in a peer reviewed or trade journal
Outcome: Publication

Date: September 2006
Objective: Verify and validate assimilation of Applied Sciences enhancements to at least one additional Public Health decision support tools (FY 06 IBPD metric identifies DHHS or affiliated sub-agencies)
Priority Candidates: HELIX; ArboNET/PSS; DHS/SCC

Date: September 2006
Objective: Complete at least one benchmark report and schedule results conferences on Applied Sciences support to Public Health decision support tools
Priority Candidates: ArboNET/PSS

Near-Term Objectives (FY07-FY09)

September 2007: Complete benchmark report on EPHTN/HELIX
September 2007: Complete V&V report on Malaria Modeling/GSAT
September 2007: Complete V&V report on RSVP
September 2008: Complete benchmark reports on RSVP, Malaria Modeling/GSAT, and DHHS/SCC
September 2008: Complete benchmark reports on projects selected in the 2005 Decision solicitation

III. Program Management and Partners

A. Program Management

Public Health Program Manager:
John Haynes,
NASA Headquarters

- Program development, strategy, plans, and budgets
- Program representation and advocate issues to Science Mission Directorate management and beyond
- Communication of Science Mission Directorate priorities and directives to Program team/network
- Represent program on inter-agency organizations (CCSP, CENR, IWGEO)
- Implementation of interagency agreements and partnerships
- Monitoring metrics and performance evaluation

Public Health Deputy Program Manager:
Robert Venezia (Acting),
NASA Stennis Space Center

- Leadership on project plans, development, performance, and partnership relationships
- Communication of project metrics, performance, status, and issues to Program Manager
- Leadership and communication to team and network
- Coordination between NASA Centers on Public Health activities
- Management of tasks at NASA John C. Stennis Space Center (SSC)

B. Public Health Network & Partners

Earth-Sun System Division and NASA Center Partners

NASA Headquarters Science Mission Directorate
- Atmospheric Composition Theme..... Phil DeCola, NASA HQ
- Carbon Cycle and Ecosystems Theme ..... Diane Wickland, NASA HQ
- Climate Variability and Change Theme ..... Waleed Abdalati, NASA HQ
- Business and Budget..... Joan Haas, NASA HQ
- Geosciences Interoperability Office ..... Myra Bambacus, NASA GSFC
- Earth Science Technology Office..... Azita Valinia, NASA GSFC

NASA Headquarters Exploration Mission Directorate
- Fundamental Space Biology..... Terry Lomax

NASA Headquarters Administration
- Chief Health and Medical Officer ..... Richard Williams
- Chief Scientist ..... John Grunsfeld

NASA Centers
- Ames Research Center (ARC) ..... Louisa Beck
- Goddard Space Flight Center (GSFC) ..... Shahid Habib
- Marshall Space Flight Center (MSFC) ..... Dale Quattrochi
- Langley Research Center (LaRC) ..... Richard Eckman
- Stennis Space Center (SSC) ..... Timi Vann, Robert Venezia

Federal Partners

Center for Disease Control (CDC)
- National Center for Environmental Health ..... Judith Qualters, Amanda Niskar
- National Center for Infectious Diseases ..... John Roehrer, Ken Gage
- National Center for Health Statistics ..... Charles Croner

EPA

- Heat Island Reduction Initiative..... Eva Wong

NIH
- Fogarty International Center ..... Joshua Rosenthal
- National Institute for Biomedical Imaging and Bioengineering
..... Roderic Pettigrew
- National Instit. of Environmental Health Sciences.....Allen Deary

Department of Defense
- Armed Forces Pest Management Board ..... Richard Johnson
- Air Force Strategic Operations Command..... Steve Lufkin, Mike Applegate

Department of Energy
- Sandia National Laboratories ..... Al Zelicoff
- Oak Ridge National Laboratories..... Budhendra Bhaduri

Department of Commerce
- NOAA Office of Global Programs..... Juli Trtanj

Department of Health and Human Services, Secretary's Command Center
- Geospatial Public Health Program.....CDR William Henriques

Department of State
- Bureau of Oceans and International
- Environmental Affairs ..... Fernando R. Echavarria

USGS..... Steve Guptill

Regional Planning Organizations Partners

None.

International, National and Regional Organizations Partners

National Science and Technology Council
- Committee on Environment and Natural Resources
- Committee on Homeland Security
- Committee on Science
- Subcommittee on Environment and Health ..... Ann Carlson

National Academy of Sciences
- National Research Council
- Board on Earth Sciences and Resources…….. David Feary

National and Organizations and Professional Societies

- American Public Health Association (APHA)..... Lynn Schoen
- Association of State and Territorial

Health Officials (ASTHO)
- Association of Schools of Public Health (ASPH) ..... Allison Foster
- Council of State and Territorial Epidemiologists (CSTE)
- International City / County

Management Association (ICMA)..... Elizabeth Stasiak
- National Association of City and County

Health Officials (NACCHO)

International Organizations

- World Health Organization

NASA Distributed Active Archive Centers and Earth-Sun science Science Laboratories

GSFC Earth Science DAAC (GES DISC DAAC) ..... Steve Kempler
SEDAC..... Robert Chen

IV. Decision Support Tools and Management Issues

Priority Decision Support Tools

EPHTN/HELIX

CDC has statutory responsibility for developing and managing EPHTN / HELIX. The system is designed to establish a national network of local, state, and federal public health agencies that tracks trends in priority chronic diseases. Around 2009, when fully functional, the EPHTN will be a national early warning system for the rapid identification of health threats, such as toxic chemical releases, including long-term data collection on harmful exposures to be used in future studies of new environment-disease correlations. Earth-Sun System science results provide available information on the environmental contribution to

ArboNET / Plague Surveillance System

Plague is an infectious disease caused by the bacteria, Yersinia pestis. Plague surveillance is a CDC priority because it is a Class A disease and, by law, all occurrence of cases or suspected cases must be reported. Plague is also monitored for its potential as a bioterrorist agent. Plague prevention and response efforts are underway at regional, state and local levels through the CDC-sponsored Arbonet / Plague Surveillance System. Arbonet is a passive surveillance system managed by the CDC to collect and archive data to study and operationally monitor regional and national arthropod-borne viral disease trends. The CDC, participating health departments, Department of Defense (DOD) and the US Geological Survey (USGS) are primary users of ArboNET. Earth-Sun System science models (e.g., the GHCN, the GMAO, and the GSFC Plague Algorithm) have the potential to provide information on plague vector habitats that enhance ArboNET forecasts of outbreak conditions. NASA's efforts to date on this project have matured to the point where technical project activities could be assumed by an external entity such as a qualified university. This topic is a focal point for the public health component of the upcoming Decisions solicitation sponsored by the NASA Applied Sciences Program. If a proposal to Decisions is selected on this topic, the programmatic support and funding may be modified.

Malaria Modeling and Surveillance

The CDC and DOD are interested in utilizing new technologies and in developing methodologies for monitoring and modeling infectious diseases. Malaria is a high priority infectious disease target for domestic agencies, such as CDC and DOD, as well as international health entities, such as the World Health Organization and the Pan American Health Organization. Malaria affects nearly 1,600 Americans each year and kills an estimated 3 million people worldwide, many of whom are children. In addition, malaria costs African nations approximately $12 billion in economic productivity losses. The health and economic consequences of malaria make it a destabilizing phenomenon. Both CDC and DOD currently are developing decision support tools to better predict and respond to malaria. Earth science data and modeling have the potential to enhance these tools by providing new information on vector habitats and environmental conditions that precede malaria outbreaks. The Global Situational Awareness Tool (GSAT) is an environmental planning tool owned and operated by the U.S. Air Force Strategic Operations Command (AFSOC). It is designed to assist military decision makers with global troop deployments by reducing time and coordination burdens. It provides environmental safety and health information to AFSOC planners and decision makers. Malaria is a disease of significant interest to the GSAT operators specifically, and military decision makers in general. NASA's efforts to date on this project have matured to the point where systems project activities can be conducted by a successful proposing organization. This topic is a focal point for the public health component of the upcoming Decisions solicitation sponsored by the NASA Applied Sciences Program. If a proposal to Decisions is selected on this topic, the programmatic support and funding may be modified.

REASoN - Rapid yndrome Validation Project (RSVP)

The RSVP is surveillance system that tracks disease syndromes and is sponsored by the Sandia National Laboratory. The system is operated in conjunction with local and state health departments and other public health entities. RSVP is designed to identify infectious disease outbreaks in the earliest possible stages and to alert public health officials to these events. Earth- Sun System science observations and modeling have the capacity to provide predictive value to the system by identifying environmental conditions that precede naturally occurring, chronic and infectious disease events.

DHHS/SCC

The Department of Health and Human Services' Secretary's Command Center [http://www.os.dhhs.gov/news/facts/command.html] was created to provide a focal point for public health information and intelligence to the Secretary of the Department of Health and Human Services (DHHS). Located in Washington, DC, the Secretary's Command Center (SCC) coordinates the activities of the DHHS with international, local, state, and federal public health authorities. Since its establishment in December 2002, the SCC's innovative design, information architecture, and business plan have become the benchmarks for similar operations centers being developed for international and federal agencies. The SCC has workstations dedicated for the Secretary, Deputy Secretary, and Assistant Secretary for Public Health Preparedness; for the Surgeon General; and for other division leaders and liaisons from other agencies. The use of the Internet protocol system creates an interoperable system of computers, radios, and telephones. Geospatial systems allow tracking and plotting of events and incidents and their relay to DHHS preparedness and response activity managers/coordinators. Through the SCC, the DHHS monitors developing public health emergencies through as many as 4,000 news media outlets across North, Central, and South America; Europe; and the Middle East. The SCC can monitor local television stations from up to 10 cities at a time to observe how breaking events are being reported across the country. NASA is currently evaluating the SCC to determine possibilities for the integration of NASA Earth science satellite observations and model predictive capabilities. The DHHS and NASA are also in the initial stages of formulating a Memorandum of Understanding between the two agencies to formalize this relationship.

Famine/Malaria Early Warning (FEWS NET/MEWS)

The U.S. Agency for International Development (USAID) provides humanitarian assistance to vulnerable populations facing slow onset disasters, due to drought or conflict, and rapid onset emergencies stemming from floods, landslides, earthquakes, tsunamis, and other disasters. The project's goal is to enhance USAID humanitarian programs by integrating NASA Earth observation and modeling results into famine and malaria early warning systems (FEWS NET/MEWS). By using NASA MODIS-AVHRR NDVI, TRMM-GPCP-CMAP precipitation, MODIS Atmosphere humidity, and NCAR reanalysis I and II products to calculate quasi-global (60S to 60N) standardized NDVI, precipitation, relative humidity, total precipitable water, and projected estimations of these indices one to four months in advance using climatology and a simple statistical approach, the project aims to significantly strengthen famine decision support. It is proposed to produce and distribute five operational indices based on global NASA data products: a standardized NDVI index (SNI), a standardized precipitation index (SPI), a standardized relative humidity index (SRI), and a standardized total precipitable water index (SQI). Standardization and broadening of the already used NDVI and precipitation to include humidity and precipitable water will significantly improve the USAID's ability to detect and quantify reductions in food production due to drought and flooding. Short-lag ëprojections' of indicators will enable decision makers to look one to four months into the future. Satellite observations will play a strong role in making these projections. NASA Earth observation and modeling results will also be integrated into early warning systems for prevention and containment of malaria epidemics. Precipitation, temperature and other environmental variables are highly correlated with malaria transmission rates. The project will use NASA precipitation estimates derived from TRMM and Aqua AMSR, temperature and precipitation fields from MM5 and NASA's fvGCM, and downscaling techniques and landscape analysis employing elevation data from GTOPO30 and SRTM to improve the timeliness and geographic specificity of malaria early warning products. Outbreaks of malaria can seriously threaten people who are already malnourished, without shelter, and whose normal livelihoods have been disrupted. Developing country organizations typically have limited resources for malaria control, and when there are malaria epidemics, available staff and supplies are overwhelmed. Improved early warning can make possible more optimal allocation and deployment of limited resources, helping to reduce rates of infection. As a consequence, U.S.-funded humanitarian assistance can be more efficient and cost-effective, and human suffering can be significantly reduced.

Three Dimensional Air Quality System (3D-AQS)

This project focuses on the application of aerosol-related NASA Earth Science observations into key DSSs used by the U.S. EPA for air quality management, air quality forecasting, and public health tracking. Metrics and budget for this project are tracked under the Air Quality Program.

GeoMedStat

GeoMedStat is an active and evolving DSS. It was developed by UMMC based on open source codes of the Real-time Oubreak and Disease Surveillance (RODS) DSS that originated at the Univ. of Pittsburgh. GeoMedStat determines disease outbreaks using both spatial and temporal variables. Based on historical data, anomalies beyond the threshold for a specific period and space are determined and warnings are generated for possible outbreak.

Potential Public Health Management Issues: FY06-FY10

Activity: The introduction of Earth-Sun System science data into public health surveillance and research increases the amount of identifying information belonging to people on whom data is recorded in public and private databases, thus increasing the risk of a breach of medical confidentiality.

This issue presents obstacles to the Public Health Program Element. It is a common source of administrative and legal concern that delays the establishment of agreements with public health agencies and slows the pace of interagency collaboration. To ensure public trust in their purpose and abilities, public health officials guard carefully the confidentiality of data on human health status and risks and are reluctant to share it with researchers without clear protocols for its use.

The nature and magnitude of these issues are relatively unfamiliar territory for NASA administrative, legal, scientific and technical personnel.

Project: Confidentiality
Budget The goal of this project is to raise awareness among aerospace and public health researchers, provide training, and establish jointly applicable protocols for the appropriate use of Earth-Sun science data.

FY06 and beyond: Collaboration with The National Academies and other key organizations on this continuing issue of importance.

Project Manager: Robert Chen-SEDAC
Centers: SEDAC
Timeframe: FY06-09
Partners: NAS
Earth Science Products: All data and capabilities are relevant
Other Apps.:
Deliverables: Policy analyses report, contact network, joint agency development reports N/A
Strategic Relevance: NASA Strategic Plan: Goals* 7.2, 7.3, 10.3
*Note: The Earth-Sun System Division does not explicitly support these particular Goals. However, this activity serves a similar purpose and contributes to NASA's overall abilities in these areas.
Activity: The CDC-NCAR Summer Institute
Budget:

FY05 0
FY06 0
FY07 0
FY08 0
FY09 0
FY10 0

The purpose of this 2-week summer institute at NCAR is to provide: 1) a uniquely interdisciplinary 1-week Climate/Health Symposium geared to scientists from multiple disciplines, as well as young scientists and advanced graduate students; and 2) a 1-week Climate Change/Health Research Summit geared to scientists working in this field to discuss and compare state-of-the-art methods. The workshop will help ensure that health researchers are aware of the types of climate (and land use) databases that are available, as well as their

optimal application. Statistics that are most relevant to climate/health study also will be taught, with the ultimate goal being to advance the quality of research on health impacts of climate change.

Project Manager: John Haynes - HQ
Centers: All Science Mission Dir. Centers
Timeframe: Summer 2006, Annual
Partners: CDC, NCAR
Earth-Sun science Products: All capabilities and data are relevant
Other Apps.:
Deliverables: Summer institute and report, network connections (including connections to DEVELOP and University of Mississippi), training N/A
Budget:

FY06 15
FY07 0K
FY08 50
FY09 0
FY10 50

The Public Health program also plans $35K in program management for support to conferences and working groups through the year.

Cross-Application Activities

The program consists of functional elements that contribute to all of the National Applications activities. The intention is to have the performance of these functions leverage accomplishments, and therefore the apparent resource investment, to the greatest extent possible into the National Applications partnerships. These functions are: Geoscience Standards and Interoperability, Human Capital Development, Integrated Benchmark Systems, and Solutions Networks. Examples of leveraged activities are:

- The Earth-Sun System Gateway is a "portal of portals" providing an access point through an Internet interface to all web-enabled NASA research results.
- A Solutions Networks capability to discover candidate configurations of NASA research results with the potential to improve partner’s decision support systems.
- A Rapid Prototyping Capability to support NASA and partners in reducing uncertainty and testing the validity of NASA research results in decision support tools.
- Systems integration capability, knowledge tools and skilled human capital to help conduct studies on the systematic transitioning of the results of research to operational uses and the capability of operational systems to support scientific research.
- A student-based, human capital development program for building capability in entry level participants in the community of practice while developing solutions for state and local applications.

V. Application Activities

A. Projects

All National Applications Program Elements authorize peer-reviewed projects to support each element's goal and objectives. To secure funding and authorization to undertake activities supporting NASA and the Applied Sciences Program, project teams are responsible for developing project plans and managing the activities. The project plans specify the Earth-Sun observations, models, and other research results to extend to decision support tools as well as the activities to produce appropriate deliverables. The plans integrate contributions from appropriate the partners, NASA Centers and other contributors from the community of practice. Projects are expected to extend the benefits of NASA research results to the maximum extent possible, including the use observations from sensors on: Aura, Terra, Aqua, TRMM, NPP, NPOESS, Hydros, Topex, Jason, OCO and Aquarius.

B. Solicitations

The Applied Sciences Program utilizes full and open competitions to fund proposals from the community to contribute the Agency's objectives. This implementation strategy will continue to be critical part of extending the benefits of NASA Earth-Sun system research results and contributing to the improvement of future operational systems. The Program has participated in providing opportunities to the community in recent solicitations, including REASoN, Decisions 2004, and Decisions under ROSES. The proposals related to this National Applications Program Element that have been funded under these solicitations are described in Section V.D. Program Element Projects.

C. Congressionally Directed Activities

As of the publication of this document, an assignment of FY06 congressionally mandated activities was not completed by the Agency.

The procurement rules and management practices of the Agency require that congressionally mandated activities follow the same principles of planning and accountability as all other funded projects. Only activities that are aligned with NASA's mission, are technically credible, and are appropriately budgeted will be approved to receive funding from the Program. The project teams of congressionally mandated activities are responsible for developing project plans and managing the activities.

D. Program Element Projects

Included below are the brief descriptions of the funded projects managed under this National Applications Program Element. Complete and detailed descriptions are documented in the Project Plans for each activity.

Project: EPHTN/HELIX — Directed Project

The goal of this project is to verify, validate and benchmark Earth-Sun science measurements for routine use in EPHTN/HELIX. FY06: Verification and validation of MODIS and ASTER requirements. FY07: Benchmarking data and modeling inputs. Expand number and scope of Earth science inputs.

Budget ($K)

Procurement

FY06	463
FY07	275
FY08	0
FY09	0
FY10	0

Project Manager	*Centers*	*Timeframe*	*Partners*
Dale Quattrochi	MSFC	FY06 - FY07	CDC

Earth Science Products

Aqua - MODIS = surface temp; Terra - ASTER, MODIS = surface temp; Models = Large Scale Eddy Simulation Model (LES)

Other Apps.

Deliverables

Description	*End Date*	*IBPD Metric #*
Evaluation Report	10/31/2004	
Design & Implement	N/A	
Verification and Validation Report	9/30/2006	6ASP11.A
Benchmark Report	9/30/2005	
Benchmark Report	9/30/2007	
Project Plan	10/1/2005	

Notes:

Project: Arbonet/Plague Surveillance System — Directed Project

The goal of this project is to benchmark Earth-Sun science measurements and models output for routine use in ArboNET. FY06: V&V activities on use of MODIS NDVI for use in plague; expand the number and scope of Earth-Sun science data products and disease surveillance targets; benchmark report.

Budget ($K)

Procurement

FY06	380
FY07	0
FY08	0
FY09	0
FY10	0

Project Manager	*Centers*	*Timeframe*	*Partners*
Compton Tucker	GSFC	FY06 - FY06	CDC

Earth Science Products

Aqua, Terra-MODIS=surface temp (MOD11), veg. index (MOD13), fract. tree cover (MOD44B); SRTM=land surface topo; Landsat 4,5,7=land cover;

Other Apps.

Deliverables

Description	*End Date*	*IBPD Metric #*
Evaluation Report	9/30/2005	
Design & Implement	N/A	
Verification and Validation Report	9/30/2006	6ASP11.A
Benchmark Report	9/30/2006	
Project Plan	10/1/2005	

Notes: Earth Science Products cont'd: Models=GSFC Plague Algorithm, GMAO, GHCN

Project: Malaria/GSAT — Directed Project

The goal of this project is to benchmark Earth science measurements for use in malaria habitat, transmission, and risk models destined for use in infectious disease surveillance systems such as GSAT. FY06: V&V Report. FY07-FY08: Benchmarking Earth-Sun science system models for use in GSAT.

Budget ($K)

Procurement

FY06	265
FY07	265
FY08	165
FY09	0
FY10	0

Project Manager	*Centers*	*Timeframe*	*Partners*
Richard Kiang	GSFC	FY06 - FY08	CDC, DOD

Earth Science Products	*Other Apps.*
EO1= radiance values; Terra - ASTER = radiance values; Landsat 7 = land cover; Aqua, Terra - MODIS = radiance values; GMAO Atmosphere Model;	

Deliverables

Description	*End Date*	*IBPD Metric #*
Evaluation Report	9/30/2005	
Design & Implement	N/A	
Verification and Validation Report	9/30/2006	
Benchmark Reports	9/30/2008	
Results conference	9/30/2008	
Project Plan	10/1/2005	

Notes: Earth Science Products cont'd: Global Historical Climatology Network Model (GHCN)

Project: DHHS SCC — Directed Project

The goal of this project is to benchmark Earth-Sun System science products for use in the DHHS SCC decision support systems. FY06: Evaluate linkage to DHHS SCC and CDC MEOC. Sign MOU with DHHS. Document the value of Earth-Sun System science results through a special edition, peer reviewed, public health journal. FY07-FY08: V&V and benchmark linkages with DHHS SCC and CDC MEOC.

Budget ($K)

Procurement

FY06	110
FY07	110
FY08	110
FY09	0
FY10	0

Project Manager	*Centers*	*Timeframe*	*Partners*
Robert Venezia	SSC	FY06 - FY08	DHHS

Earth Science Products: To be identified in evaluation effort.

Other Apps.

Deliverables

Description	*End Date*	*IBPD Metric #*
Evaluation Report	9/30/2005	
Design & Implement	N/A	
Verification and Validation Report	9/30/2007	
Benchmark Report	9/30/2008	
Results conference		
Project Plan	10/1/2005	

Notes:

Project: Workshops, Conferences, etc.				Project Management	
Activities of the Public Health Working Group. Co-Sponsor IOOS/PH Workshop, EcoHealth Conference, and CDC/NCAR Summer Institute (as well as similar activities in out years).				*Budget ($K)* *Procurement*	
				FY06	50
Project Manager	*Centers*	*Timeframe*	*Partners*	FY07	50
John Haynes	All	FY06 - FY10	NAS, CDC, NCAR, SEDAC, etc.	FY08	50
				FY09	50
				FY10	50
Earth Science Products	All data and capabilities are relevant			*Other Apps.*	
Deliverables	*Description*	*End Date*	*IBPD Metric #*		
	Evaluation Report				
	Design & Implement				
	Verification and Validation Report				
	Benchmark Report				
	Project Plan	10/1/2005			
Notes:					

Project: PHAiRS/RSVP (REASoN) — Solicitation

The goal of this project is to evaluate, verify, validate and benchmark Earth-Sun science measurements for use in an existing public health syndromic surveillance system. FY06-07: verify and validate dust measurements and models for use in respiratory diseases addressed by RSVP. FY08: Benchmark dust measurements and models and extend RSVP by integrating additional Earth-Sun System science results.

Budget ($K)

Procurement

FY06	700
FY07	700
FY08	300
FY09	0
FY10	0

Project Manager	*Centers*	*Timeframe*	*Partners*
Robert Venezia	SSC	FY06 - FY08	DOE, UNM, UoA

Earth Science Products

Terra, Aqua, ACRIMSAT, ERBS, Landsat-7, TOMS-EP, TRMM, and EO-1 data on incoming solar radiation, surface temperature, atmospheric constituents, air quality, soil moisture,

Other Apps.

Deliverables

Description	*End Date*	*IBPD Metric #*
Evaluation Report	10/31/2004	
Design & Implement	N/A	
Verification and Validation Report	9/30/2007	
Benchmark Report	9/30/2005	
Monthly metrics reports		
Benchmark Report	9/30/2008	
Project Plan	10/1/2005	
Quarterly written reports		

Notes: Earth Science Products cont'd: NDVI, wind speed, and direction, trace gas concentration in the troposphere, aerosol concentration, rain rate and amount. Models: MAESTRO/MAESTRA, Catchment Land Surface Model, NCEP/ETA, DREAM, NARAC/ERS, HOTMAC/RAPTAD, COAMPS

Project: Enhancing USAID Famine and Malaria Early Warning with NASA Earth Science Results (FEWS NET/MEWS) — Solicitation

The U.S. Agency for International Development (USAID) provides humanitarian assistance to vulnerable populations facing slow onset disasters, due to drought or conflict, and rapid onset emergencies stemming from floods, landslides, earthquakes, tsunamis, and other disasters. The project's goal is to enhance USAID humanitarian programs by integrating NASA Earth observation and modeling results into famine and malaria early warning systems (FEWS NET/MEWS). By using NASA MODIS-AVHRR NDVI, TRMM-GPCP-CMAP precipitation, MODIS Atmosphere humidity, and NCAR reanalysis I and II products to calculate quasi-global (60S to 60N) standardized NDVI, precipitation, relative humidity, total precipitable water, and projected estimations of these indices one to four months in advance using climatology and a simple statistical approach, the project aims to significantly strengthen famine decision support.

Budget ($K)

Procurement

FY06	467
FY07	467
FY08	0
FY09	0
FY10	0

Project Manager	*Centers*	*Timeframe*	*Partners*
Robert Venezia	GSFC	FY05 - FY07	USGS, USAID

Earth Science Products

NASA MODIS-AVHRR NDVI, TRMM-GPCP-CMAP precipitation, MODIS Atmosphere humidity, Aqua AMSR, SRTM.

Other Apps.

Deliverables

Description	*End Date*	*IBPD Metric #*
Evaluation Report	9/30/2006	
Design & Implement		
Verification and Validation Report	9/30/2007	
Benchmark Report	9/30/2008	

Notes: Earth Science Products cont'd: Temperature and precipitation fields from the MM5 and NASA's fvGCM models.

Project: Three Dimensional Air Quality System (3D-AQS) — Solicitation

This project focuses on the application of aerosol-related NASA Earth Science observations into key DSSs used by the US EPA for air quality management, air quality forecasting, and public health tracking. Metrics and budget for this project are tracked under the Air Quality Program.

Budget ($K)

Procurement

FY06	0
FY07	0
FY08	0
FY09	0
FY10	0

Project Manager	*Centers*	*Timeframe*	*Partners*
Lawrence Friedl	LaRC/GSFC	FY05 - FY07	EPA, NOAA

Earth Science Products

MODIS, Aura/OMI, CALIPSO, AIRS, MPLNET, REALM, AERONET, and NOAA GOES.

Other Apps.

Air Quality

Deliverables

Description	*End Date*	*IBPD Metric #*
Evaluation Report	9/30/2006	
Design & Implement		
Verification and Validation Report	9/30/2007	
Benchmark Report	9/30/2008	

Notes:

<table>
<tr><td colspan="4">Project: GeoMedStat</td><td colspan="2">Solicitation</td></tr>
<tr><td colspan="4" rowspan="2">GeoMedStat is an active and evolving DSS. It was developed by UMMC based on open source codes of the Real-time Oubreak and Disease Surveillance (RODS) DSS that originated at the Univ. of Pittsburgh. GeoMedStat determines disease outbreaks using both spatial and temporal variables. Based on historical data, anomalies beyond the threshold for a specific period and space are determined and warnings are generated for possible outbreak. The objective of this project is to enhance GeoMedStat for asthma surveillance, prediction, and intervention by integrating it with NASA research results.</td><td colspan="2">Budget ($K)

Procurement</td></tr>
<tr><td>FY06</td><td>0</td></tr>
<tr><td>Project Manager</td><td>Centers</td><td>Timeframe</td><td>Partners</td><td>FY07</td><td>0</td></tr>
<tr><td rowspan="3">Fazlay
Faruque</td><td rowspan="3">MSFC</td><td rowspan="3">FY05 - FY07</td><td rowspan="3">MDoH, MDEQ, CDC</td><td>FY08</td><td>0</td></tr>
<tr><td>FY09</td><td>0</td></tr>
<tr><td>FY10</td><td>0</td></tr>
<tr><td>Earth Science Products</td><td colspan="3">MODIS, Aura/OMI</td><td colspan="2">Other Apps.</td></tr>
<tr><td>Deliverables</td><td colspan="3"><u>Description</u> <u>End Date</u> <u>IBPD Metric #</u>
Evaluation Report
Design & Implement
Verification and Validation Report
Benchmark Report
Final Report 9/30/2007</td><td colspan="2"></td></tr>
<tr><td colspan="6">Notes:</td></tr>
</table>

E. Additional Activities & Linkages

None.

E. IBS Request

None.

Program Response to IBS Request

To be supplied by program management.

E. Crosscutting Request

None.

Program Response to Crosscutting Request

To be supplied by program management.

VI. Budget: FY06-010

The following table lists the Public Health Program budget (procurement) for FY2006:

Project	FY06 Procurement Allocation ($K)
EPHTN/HELIX	$ 463
Arbonet/Plague Surveillance System	$ 380
Malaria/GSAT	$ 265
DHHS SCC	$ 110
PHAiRS/RSVP (REASoN)	$ 700
Workshops, Conferences, etc.	$ 50
Enhancing USAID Famine and Malaria Early Warning with NASA Earth Science Results (FEWS NET/MEWS)	$ 467
Three Dimensional Air Quality System (3D-AQS)	$ 0
GeoMedStat	$ 0
Total =	$ **2435**

Appendix C lists program-wide budget allocations for FY2006-10.

VII. Program Management and Performance Measures

The Public Health Program Management Team uses performance measures to track progress, identify issues, evaluate projects, make adjustments, and establish results of the program element. The Program's goals and objectives state what the Program intends to achieve. These measures help monitor progress within and across specific activities to ensure the Program meets its goals and objectives. The Management Team analyzes these measures retrospectively in order to made adjustments proscriptively to the Program approach and objectives.

The measures are in two categories: Program Management measures are internally focused to assess the activities within the Program. Performance measures are externally focused to assess if the program activities are serving their intended purpose. In general, the Public Health Program Manager uses these measures to evaluate the performance of activities conducted and sponsored by the Program, especially the projects. In addition, the Applied Sciences Program uses this information in preparing IBPD directions and PART responses.

Program Management Measures (Internal):

Inputs:
1) Potential issues and DST identified for public health – number, type, range
2) Eligible partners to collaborate with – number, type, range
3) Potential results/products identified to serve public health – number, type, range

Outputs:
1) Assessments or evaluations of DST – number, range
2) Assessments of Earth science results/products to serve DST – number, range
3) Agreements with partners – presence
4) Reports (evaluation, validation, benchmark) – number, type

Quality and Efficiency:
1) Earth-Sun System science results/products – number used per DST, ratio of utilized to potential
2) Agreements – ratio of agreements to committed partners
3) Reports – partner satisfaction, timeliness, time to develop
4) Reports – ratio of validations to potential products, ratio of benchmarks to validations

Performance and Results Measures (External):

Outcomes:
1) Earth science products adopted in DST – number, type, range; use in DST over time
2) Earth science products in use – ratio of products used by partners to reports produced
3) Partner & DST performance – change in partner DST performance, number and type of public recognition of use and value of Earth science data in DST

Impacts:
1) Partner value – change in partner metrics (improvements in value of partner decisions)

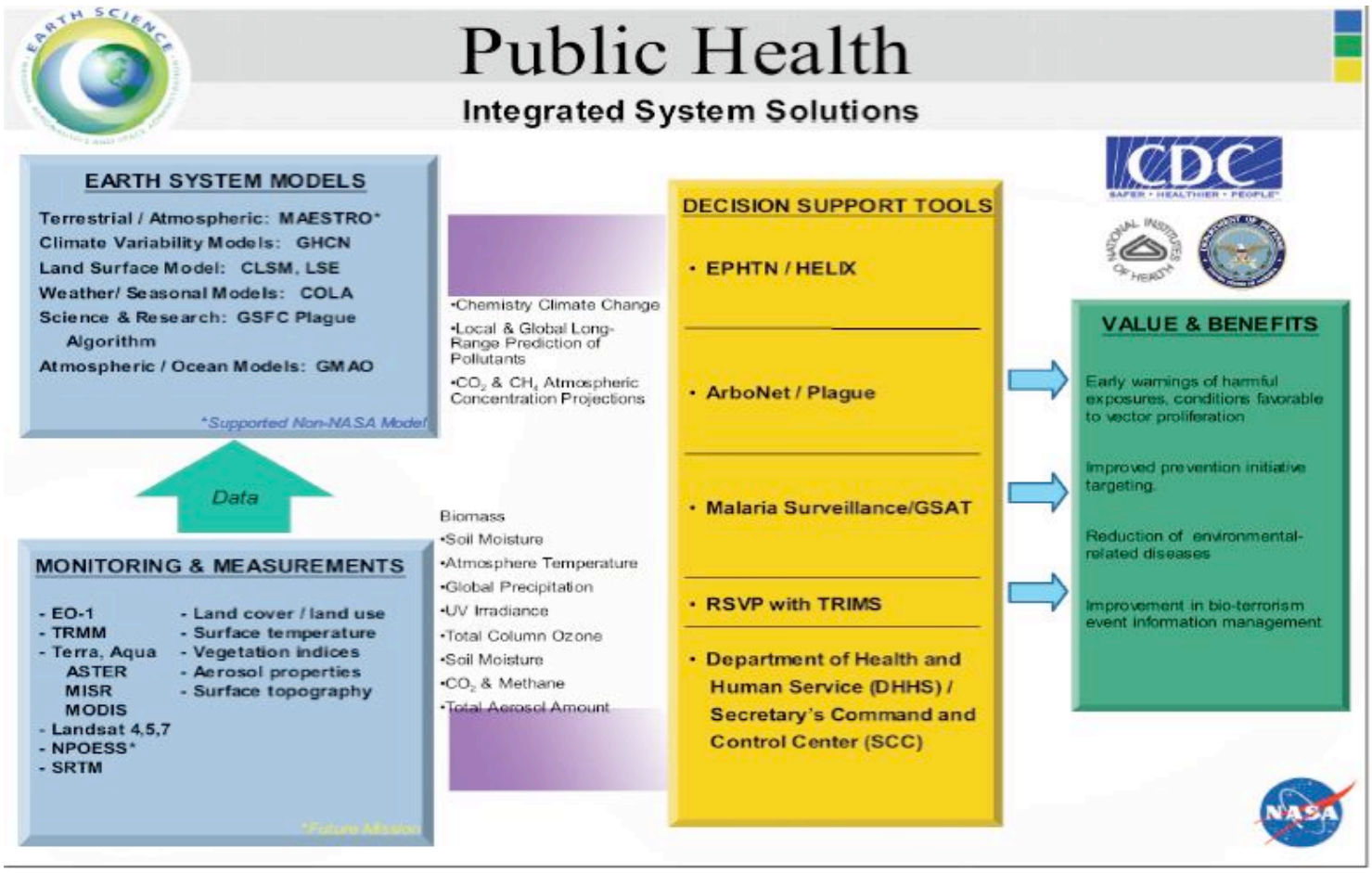
In addition to the stated measures, the Public Health Program Manager periodically requests an assessment of its

plans, goals, priorities, and activities through external review. The Public Health Program Team uses these measures along with comparisons to programmatic benchmarks to support assessments of the Earth Science Applications Program (e.g. internal NASA reviews and OMB PART). In specific, the Public Health Program Manager uses comparisons to similar activities (i.e. program benchmarks) to evaluate its progress and achievements.

VIII. Appendicies

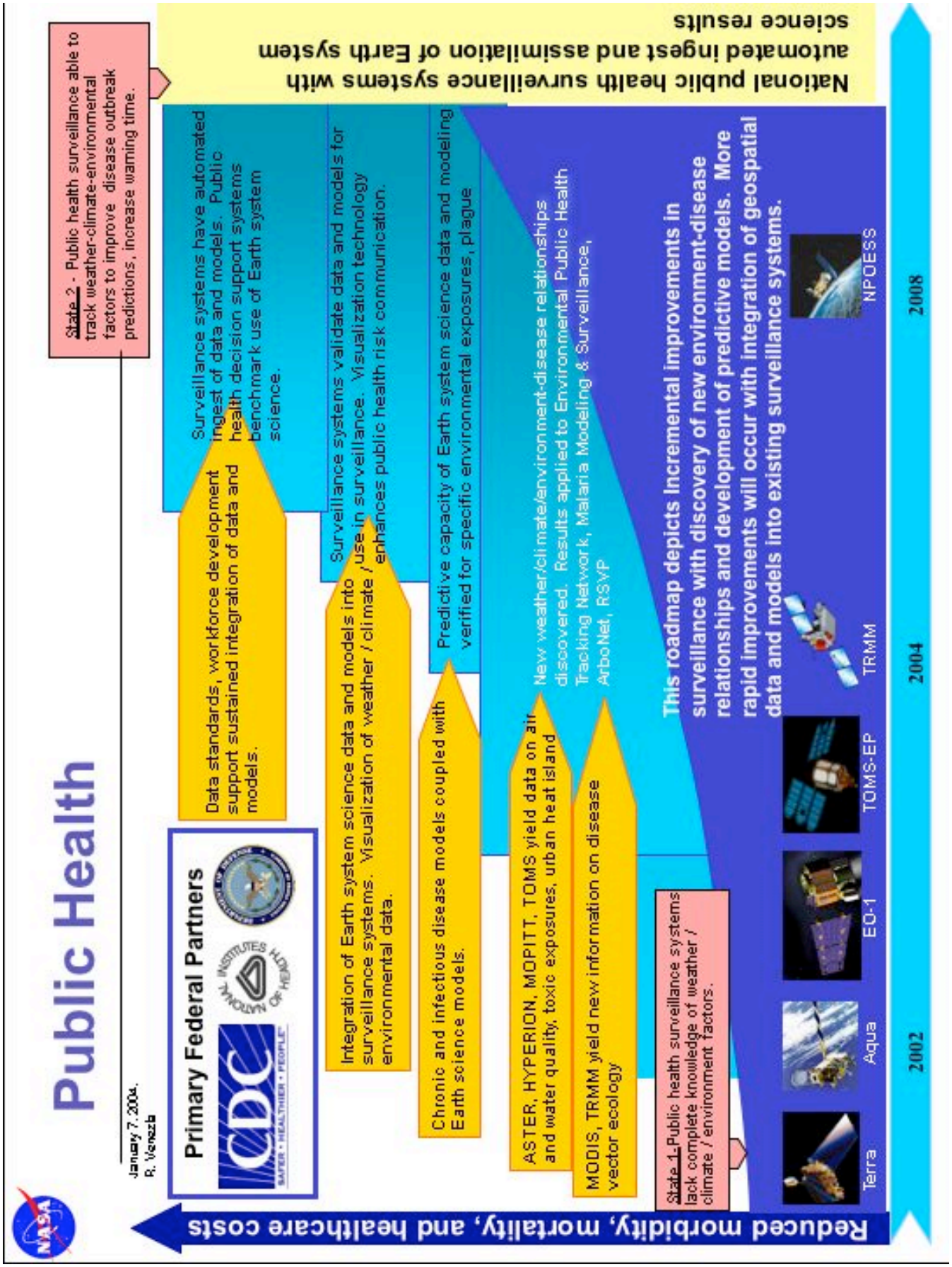
A. Integrated System Solutions Diagram

This figure illustrates the extension of Applied Sciences measurements, model products, and data fusion techniques to support the Public Health Program partners, their decision support tools, and the value and benefits of Earth science to society.



B. Roadmap

The Public Health Program draws upon technology and data from Earth-Sun system science missions such as Aqua, Landsat 7, NOAA-POES, Terra, TOMS, and TRMM. These and other systems provide information on environmental features that are correlated with disease risk factors or are risk factors themselves. The incorporation of Earth-Sun science research and models into public health surveillance systems enhances their ability to assimilate the role of weather, climate and environmental risk factors - in place and time - to predict disease events.


Public Health
January 7, 2004.
R. Wenzel
Primary Federal Partners
CDC
NATIONAL INSTITUTES OF HEALTH
Reduced morbidity, mortality, and healthcare costs
National public health surveillance systems with automated ingest and assimilation of Earth system science results
State 2 - Public health surveillance able to track weather-climate-environmental factors to improve disease outbreak predictions, increase warning time.
Data standards, workforce development support sustained integration of data and models.
Surveillance systems have automated ingest of data and models. Public health decision support systems benchmark use of Earth system science.
Integration of Earth system science data and models into surveillance systems. Visualization of weather / climate / environmental data.
Surveillance systems validate data and models for use in surveillance. Visualization technology enhances public health risk communication.
Chronic and infectious disease models coupled with Earth science models.
Predictive capacity of Earth system science data and modeling verified for specific environmental exposures, plague
ASTER, HYPERION, MOPITT, TOMS yield data on air and water quality, toxic exposures, urban heat island
New weather/climate/environment-disease relationships discovered. Results applied to Environmental Public Health Tracking Network, Malaria Modeling & Surveillance, ArboNet, RSVP
MODIS, TRMM yield new information on disease vector ecology
State 1 Public health surveillance systems lack complete knowledge of weather / climate / environment factors.
This roadmap depicts incremental improvements in surveillance with discovery of new environment-disease relationships and development of predictive models. More rapid improvements will occur with integration of geospatial data and models into existing surveillance systems.
Terra
Aqua
EO-1
TOMS-EP
TRMM
NPOESS
2002
2004
2008

C. Applied Sciences Program Budgets FY2006-10

The following figures represent the FY06 budgets for the respective Program Elements; they do not represent the entire Applied Sciences Program budget. There is an additional $8.95million in Congressionally-directed activities and $5million for the Mississippi Research Consortium that these figures do not incorporate.

Program Element	FY06 Procurement Allocation
National Applications	
Agricultural Efficiency	$ 1,955,803
Air Quality	$ 3,116,464
Aviation	$ 3,048,878
Carbon Management	$ 1,544,831
Coastal Management	$ 1,416,233
Disaster Management	$ 2,743,760
Ecological Forecasting	$ 3,240,170
Energy Management	$ 1,875,253
Homeland Security	$ 1,987,054
Invasive Species	$ 2,241,940
Public Health	$ 3,356,124
Water Management	$ 1,714,341
Crosscutting Solutions	
DEVELOP	$ 1,498,000
Geospatial Interoperability	$ 2,400,000
Solutions Networks	$ 2,822,000
Integrated Benchmarking System	$ 4,500,000

The following figures show the five-year run-out for the entire Applied Sciences Program. The figures are based on the FY07 President's budget submitted to Congress. The lower line shows the target budget including agency corporate and institutional adjustments.

	2006	2007	2008	2009	2010
Present Budget Summited to Congress	53,254,855	51,049,000	50,287,000	48,588,000	48,662,000
Target After Adjustments	47,321,663	39,101,000	33,922,000	34,801,000	34,803,000

D. Related NASA and Partner Solicitations and Grants

Appendix D lists NASA Earth-Sun system science research projects, Earth science fellowships, GLOBE activities, and Earth science New Investigators related to Public Health activities.

Institution	*PI*	*Title/Subject*	*Timeframe*
None		None listed	

E. Acronyms and Websites

ACRONYMS:

ACRIMSAT	Active Cavity Radiometer Irradiance Monitor Satellite
AFSOC	Air Force Strategic Operations Command
AIWG	Applications Implementation Working Group
APHA	American Public Health Association
Arbonet	Passive Surveillance System (CDC Plague Surveillance System)
ARC	Ames Research Center
ASPH	Association of Schools of Public Health
ASTER	Advanced Spaceborne Thermal Emission and Reflectance Radiometer
ASTHO	Association of State and Territorial Health Officials
CCSP	Climate Change Science Program
CCTP	Climate Change Technology Program
CDC	Centers for Disease Control and Prevention
CENR	Committee on Environment and Natural Resources
CLSM	Catchment Land Surface Model
CSTE	Council of State and Territorial Epidemiologists
DAAC	Distributed Active Archive Center (Data Active Archive Center)
DEVELOP	No longer an acronym
DHHS	Department of Health and Human Services
DOC	US Department of Commerce
DOD	US Department of Defense
DOE	US Department of Energy
DREAM	Distance Routing Effect Algorithm for Mobility
DST	Decision Support Tool
EO-1	Earth Observing-1
EPA	US Environmental Protection Agency
EPHTN	Environmental Public Health Tracking Network
ERBS	Earth Radiation Budget Satellite
ERS	Emergency Response System
ESG	Earth-Sun Gateway
ETA	Event Tree Analysis
FEA	Federal Enterprise Architecture
FY	Fiscal Year
GES	Geospatial Extension Service
GEO	ad hoc Group on Earth Observations
GHCN	Global Historical Climatology Network Model
GIG	Global Information Grid
GMAO	Global Modeling and Assimilation Office
GSAT	Global Satellite Data Acquisition Team/Global Situational Awareness Tool
GSFC	Goddard Space Flight Center
HELIX(	High Energy Laser Iodine Extraction Code) Health and Environment Linked Information Exchange System

HOTMAC	High Order Turbulence Model For Atmospheric Circulations
IBPD	Integrated Budget and Performance Document
ICMA	International City/County Management Association
IWGEO	Interagency Working Group on Earth Observations
JCSDA	Joint Center for Satellite Data Assimilation
LaRC	Langley Research Center
LES	Large Scale Eddy Simulation Model
MAESTRA	European Spacecraft
MAESTRO	European Spacecraft
MEOC	Marine Emergency Operation Center /Marcus Emergency Operations Center
MODIS	Moderate Resolution Imaging Spectroradiometer
MS DoH	Mississippi Department of Health
MSFC	Marshall Space Flight Center
NACCHO	National Association of City and County Health Officials
NARAC	National Atmospheric Release Advisory Center
NAS	National Academy of Sciences
NASA HQ	NASA Headquarters
NASA	National Aeronautics and Space Administration
NCAR	National Center for Atmospheric Research
NCEP	National Centers for Environmental Prediction
NDVI	Normalized Difference Vegetation Index
NESDIS	National Environmental Satellite Data Information Service
NIH	National Institute of Health
NOAA	National Oceanic and Atmospheric Administration
NPOESS	National Polar-Orbiting Operational Environmental Satellite System
NSF	National Science Foundation
NSTC	National Science and Technology Council's
NWS	National Weather Service
OAR	Office of Oceanic and Atmospheric Research
OMB	Office of Management and Budget
OSSE	Observing System Simulation Experiment
OSTP	Office of Science and Technology Policy
PART	Program Assessment Rating Tool
POES	Polar Orbiting Environmental Satellites
PSS	Plague Surveillance System
R2O	Research to Operations Network
RAPTAD	Random Particle Transport and Diffusion
REASoN	Research, Education, and Applications Solutions Network
RSVP	Rapid Syndrome Validation Project
SCC	Secretary's Command Center
SEA	State Enterprise Architecture
SeaWiFS	Sea-viewing Wide-Field-of-View Sensor
SEDAC	Socio Economic Data and Application Center
SEEDS	Strategic Evolution of ESE Data Systems
SRTM	Shuttle Radar Topography Mission

SSC	Stennis Space Center
THORPEX	The Observing-System Research and Predictability Experiment
TOMS	Total Ozone Mapping Spectrometer
TOMS-EP	Total Ozone Mapping Spectrometer – Earth Probe
TRMM	Tropical Rainfall Measurement Mission
UCAR	University Corporation for Atmospheric Research
USGS	United States Geological Survey
VAccess	Virginia Access
WHO	World Health Organization
WMO	World Meteorological Organization

WEBSITES:

IWG: http://aiwg.gsfc.nasa.gov
Applied Sciences Program: http://science.hq.nasa.gov/earth-sun/applications
DEVELOP: http://develop.larc.nasa.gov
Earth-Sun System Gateway (ESG): http://esg.gsfc.nasa.gov/
Earth-Sun Science System Components: http://www.asd.ssc.nasa.gov/m2m
NASA FY2005 Budget: http://www.ifmp.nasa.gov/codeb/budget2005
Research and Analysis Program: http://science.hq.nasa.gov/earth-sun/science/
Science Mission Directorate: http://science.hq.nasa.gov
Science Strategies: http://science.hq/nasa.gov/strategy/